

Question 1: In Python, which of the following best describes the difference between a list and a tuple?

- a) Lists are always sorted; tuples are not.
- b) Lists are mutable (changeable) while tuples are immutable.
- c) Tuples consume more memory and are always slower.
- d) Tuples can be indexed; lists cannot.

Question 2: In a singly linked list, to reverse the list in-place, which approach is best?

- a) Swap data of head and tail only.
- b) Copy values into an array, sort it, reconstruct the linked list.
- c) Iterate through nodes and redirect each node's next pointer using three-pointer technique.
- d) Create a separate new list and append nodes from the old list without changing pointers.

Question 3: A small website suffered a SQL injection attack because input was concatenated directly into SQL queries. Which immediate fix is most appropriate?

- a) Only run the site on weekends.
- b) Encrypt the database and hope SQL injection will stop.
- c) Convert all SQL to uppercase text.
- d) Use prepared statements / parameterized queries and validate inputs server-side.

Question 4: In HTML, which element is used to semantically represent the primary navigation links?

- a) `<script>`
- b) `<div>`
- c) `<nav>`
- d) `<footer>`

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Question 5: In SQL, which statement returns both existing rows and one new computed column showing average of a numeric column score across all rows (use aggregate correctly)?

- a) `SELECT id, score, AVG(score) FROM table GROUP BY id;`
- b) `SELECT id, score, AVG(score) FROM table;`
- c) `SELECT id, score, AVG(score) OVER () AS avg_score FROM table;`
- d) `SELECT * FROM table WHERE score = AVG(score);`

Question 6: In machine learning, what is meant by “overfitting”?

- a) A model that is physically too large to run on a GPU.
- b) A model fits training data very well but performs poorly on new/test data due to learning noise or too complex a model.
- c) When the dataset is too small to store in memory.
- d) When model accuracy is exactly 100% on test set reliably.

Question 7: Which Java visibility modifier allows access only within the same package?

- a) `private`
- b) `public`
- c) (default) package-private
- d) `global`

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Question 8: Which data structure is most appropriate for implementing a LIFO (last in, first out) behaviour?

- a) Queue
- b) Stack
- c) Hash table
- d) Binary search tree

Question 9: A team needs to speed up page load for a web app with many static assets. Which is the best combination of actions?

- a) Enable browser caching, minify CSS/JS, and serve assets via a CDN.
- b) Remove all images from the site permanently.
- c) Increase HTML complexity and inline all scripts uncompressed.
- d) Require users to download a 200 MB installer before viewing the site.

Question 10: In Python, which statement correctly opens a file for reading and ensures it is closed automatically?

- a) `with open('file.txt', 'r') as f:`
- b) `f = open('file.txt');`
- c) `open('file.txt', 'r')`
- d) `file.open('file.txt')`

Question 11: In algorithm analysis, which notation describes an upper bound on runtime growth?

- a) Big O notation
- b) Theta notation
- c) Omega notation
- d) Big Q notation

Question 12: Which HTTP status code indicates that a resource was not found?

- a) 404
- b) 200
- c) 500
- d) 302

Question 13: In databases, what is a foreign key used for?

- a) To enforce referential integrity by linking to a primary key in another table.
- b) To store encrypted passwords only.
- c) To speed up client-side rendering.
- d) To uniquely identify a row within the same table like a primary key.

Question 14: Which sorting algorithm has average-case time complexity $O(n \log n)$ and is generally efficient in practice?

- a) Merge sort or quicksort
- b) Bubble sort
- c) Insertion sort
- d) Sleep sort

Question 15: A user reports repeated phishing emails that mimic the company login page. Which immediate security action should the org prioritize?

- a) Ask users to forward phishing to social media.
- b) Delete all company email accounts and never use email again.
- c) Notify users, reset exposed credentials, enforce MFA, and educate about phishing indicators.
- d) Change the company logo only.

Question 16: In CSS, which property controls the spacing between lines of text?

- a) `font-family`
- b) `letter-spacing`
- c) `text-indent`
- d) `line-height`

Question 17: In a binary search tree (BST), what is the time complexity of searching for a value in a balanced tree with n nodes?

- a) $O(1)$
- b) $O(n)$ always
- c) $O(n^2)$
- d) $O(\log n)$

Question 18: In Python, what is a generator (using `yield`) primarily used for?

- a) To generate visual graphics only.
- b) To produce an iterator lazily, yielding values on demand and saving memory.
- c) To permanently store values on disk automatically.
- d) To replace `print()` for logging.

Question 19: Which security practice least helps protect passwords in storage?

- a) Storing salted, slow cryptographic hashes (e.g., `bcrypt`).
- b) Using reversible encryption without proper key management.
- c) Using unique, per-user salts.
- d) Iterating hash function to slow brute-force attacks.

Question 20: You need to get customers with no orders (left join). Which clause finds rows in left table with no matching right-table row?

- a) `LEFT JOIN orders ON customers.id = orders.customer_id WHERE orders.id IS NULL`
- b) `INNER JOIN`
- c) `CROSS JOIN`
- d) `RIGHT JOIN`

Question 21: In machine learning supervised learning, the dataset contains input features and:

- a) target labels/outputs used to train the model.
- b) only unlabelled data always.
- c) no inputs only outputs.
- d) only metadata like timestamps.

Question 22: Which HTTP method is typically used to update resources partially (idempotent in some APIs)?

- a) `DELETE`
- b) `GET`
- c) `PATCH`
- d) `TRACE`

Question 23: Which data structure is ideal for implementing Dijkstra's algorithm efficiently?

- a) Single queue for BFS only.
- b) Simple stack only.
- c) Plain list with no priority logic.
- d) Priority queue (min-heap) to select the next node with smallest tentative distance.

Question 24: In Java, what does the `static` keyword indicate when applied to a method?

- a) The method automatically runs on separate threads.
- b) The method cannot be used anywhere.
- c) The method belongs to the class rather than a particular instance.
- d) The method is encrypted.

Question 25: A REST API returns sensitive user data over HTTP (no TLS). Which immediate vulnerability exists and how to fix?

- a) Only change response content length.
- b) Nothing is wrong; plaintext is fine for APIs.
- c) Compress responses to hide data.
- d) Data transmitted in plaintext is subject to eavesdropping; enforce HTTPS/TLS and secure headers.

Question 26: Which SQL concept prevents multiple concurrent transactions from causing inconsistent data?

- a) Only use client-side caching.
- b) Just reading data without locks always prevents conflicts.
- c) Deleting data frequently avoids conflicts.
- d) Transactions with proper isolation levels (ACID properties).

Question 27: In Python, which built-in data type would you use to represent key→value pairs efficiently?

- a) `set` for ordered key/value pairs
- b) `list` only
- c) `tuple` only
- d) `dict` (dictionary/hash map)

Question 28: Which algorithmic technique divides a problem into overlapping subproblems and stores solutions to avoid recomputation?

- a) Random guessing
- b) Brute force only
- c) Greedy always
- d) Dynamic programming (memoization/tabulation)

Question 29: Which semantic HTML element is most appropriate to mark the main content of a page?

- a) `<b>`
- b) `<aside>`
- c) `<main>`
- d) `<meta>`

Question 30: Which SQL command removes all rows from a table but is typically faster and may not be transactional?

- a) `DELETE * FROM table_name WHERE TRUE;`
- b) `DROP TABLE table_name;` (removes table itself)
- c) `TRUNCATE TABLE table_name;`
- d) `SELECT * FROM table_name;`

Question 31: You design a chatbot that must not reveal private user data during conversations. Which design principle is most important?

- a) Allow any answer to be returned for speed.
- b) Implement strict data access controls, mask or avoid exposing PII, and audit responses for leakage.
- c) Store all conversational data in public logs for training.
- d) Hardcode sample user passwords into the bot responses.

Question 32: Which complexity class describes problems solvable in polynomial time?

- a) NP (not necessarily solvable in poly time)
- b) P
- c) EXP (exponential time)
- d) Unknown

Question 33: In CSS Flexbox, which property defines the main axis direction?

- a) `align-items`
- b) `flex-direction`
- c) `justify-content`
- d) `display`

Question 34: Which index type in databases is best when you need to enforce uniqueness and speed exact-match queries?

- a) Bitmap index only always
- b) B-tree (or unique index)
- c) No index at all is best
- d) Random hash thrown away

Question 35: What is the role of a validation set during model development?

- a) To train the model weights primarily.
- b) To tune hyperparameters and prevent overfitting before final testing on test set.
- c) To replace the test set entirely.
- d) To store production logs.

Question 36: In cybersecurity, what does the principle of least privilege mean?

- a) Grant random privileges occasionally.
- b) Give users all permissions to reduce admin overhead.
- c) Give users only the minimum permissions needed to perform their tasks.
- d) Never use permissions at all.

Question 37: Which tree traversal visits nodes in left-root-right order (in-order)?

- a) In-order traversal (left, root, right) typically yields sorted order for BST.
- b) Pre-order (root, left, right)
- c) Post-order (left, right, root)
- d) Level-order only

Question 38: In JavaScript, which operator tests both value and type equality?

- a) `===`
- b) `==`
- c) `=`
- d) `!=`

Question 39: You must design a many-to-many relationship between `students` and `courses`. Which approach is standard?

- a) Store relationships in filenames on disk.
- b) Add 100 columns to `students` table for each possible course.
- c) Denormalize everything into a single huge text field.
- d) Create a junction/link table (e.g., `enrollments` with `student_id` and `course_id`).

Question 40: Which algorithm is appropriate for searching an element in a sorted array efficiently?

- a) Exponential insertion.
- b) Linear search always better.
- c) Bubble search algorithm.
- d) Binary search — $O(\log n)$ time.

Question 41: Which HTTP header helps defend against clickjacking by controlling whether the page may be framed?

- a) Date
- b) Content-Type only
- c) Server header
- d) X-Frame-Options: DENY OR SAMEORIGIN

Question 42: In Python, which structure is best for representing an adjacency list for a graph?

- a) A float matrix always
- b) A single integer variable
- c) A string concatenation of edges only
- d) A dictionary mapping node → list of neighbor nodes (dict[node] = [neighbors])

Question 43: In algorithms, what is the main idea of divide-and-conquer?

- a) Avoid recursion entirely.
- b) Conquer problems by brute force only.
- c) Randomly guess answers and verify later.
- d) Divide the problem into subproblems, solve each recursively, and combine the results.

Question 44: Cross-Site Scripting (XSS) attacks are prevented primarily by:

- a) Increasing server CPU.
- b) Disabling JavaScript globally for all users.
- c) Blocking all images only.
- d) Properly encoding or escaping user-supplied content before inserting into web pages and using Content Security Policy.

Question 45: Which Python construct is used for handling exceptions?

- a) for
- b) if
- c) try / except
- d) switch

Question 46: In a relational database, which property ensures that transactions are processed reliably?

- a) Denormalization exclusively
- b) CRUD only
- c) ACID properties (Atomicity, Consistency, Isolation, Durability)
- d) Using only text files

Question 47: A small ML model gives poor performance because features are on very different scales. What is the best pre-processing step?

- a) Shuffle labels only
- b) Remove half the data randomly.
- c) Normalize or standardize features..
- d) Add random noise to labels.

Question 48: Which tool or technique helps detect open ports and services on a network for security auditing?

- a) Browser bookmarks.
- b) Word processor macros.
- c) Port scanner (e.g., Nmap)
- d) Screen saver settings.

Question 49: In HTML forms, which attribute specifies where the form data should be sent?

- a) `href`
- b) `method`
- c) `action`
- d) `src`

Question 50: Which SQL clause restricts which rows are returned by a query?

- a) `WHERE`
- b) `GROUP BY`
- c) `ORDER BY`
- d) `JOIN`

Question 51: Which basic neural network unit computes a weighted sum of inputs and applies an activation function?

- a) Neuron (perceptron / artificial neuron)
- b) Router hardware only
- c) Database index
- d) CSS selector

Question 52: A dev sets file permissions `chmod 777` on a production folder. What is the main risk?

- a) It grants read/write/execute to everyone, increasing risk of unauthorized modification or code execution; use least privilege and correct ownership instead.
- b) It speeds up the server significantly.
- c) It prevents anyone from accessing files forever.
- d) It encrypts files automatically.

Question 53: Which data structure is optimal for implementing 'undo' functionality (reverse recent actions)?

- a) Stack
- b) Queue
- c) Binary heap only
- d) Hash table only

Question 54: Which join returns rows common to both tables based on join condition?

- a) `LEFT JOIN` only
- b) `INNER JOIN`
- c) `RIGHT JOIN` only
- d) `FULL OUTER JOIN` only

Question 55: In supervised machine learning, what does the term “feature engineering” refer to?

- a) Engineering physical structures for features in hardware.
- b) The process of creating/transforming input variables (features) to improve model performance.
- c) A debugging tool only.
- d) A method for compressing images.

Question 56: In JavaScript, which event model pattern allows code to respond when a user clicks a button?

- a) Use CSS to handle click logic entirely.
- b) Add an event listener (e.g., `element.addEventListener('click', handler)`)
- c) Change HTML only; browser decides behavior.
- d) Assign a filename to the element.

Question 57: Which hashing property is critical for storing passwords securely?

- a) Use a slow, salted hash function (e.g., bcrypt/argon2) to resist brute-force attacks.
- b) Use MD5 with no salt because it's fast.
- c) Store passwords in plain text but compress them.
- d) Use reversible base64 encoding.

Question 58: Which traversal is best to evaluate an expression tree to compute its numeric result (assuming binary operators)?

- a) Post-order traversal (evaluate left, right, then operator)
- b) Pre-order only
- c) In-order only (without operator precedence handling)
- d) Random traversal

Question 59: In RESTful API design, which status code typically indicates a successful resource creation?

- a) 500 Internal Server Error
- b) 404 Not Found
- c) 403 Forbidden
- d) 201 Created

Question 60: During a code review you find a function that has grown to 400 lines and mixes I/O, business logic, and database calls. What is the best refactoring strategy?

- a) Break the function into smaller functions with single responsibilities (extract code paths into modules), improving testability and maintainability.
- b) Leave it as is to avoid changing working code.
- c) Merge the function into a single huge class with more methods but no separation.
- d) Replace all logic with comments only.